



COMPUTER AND DATA SYSTEMS FACILITIES

Purpose:

To design and develop computer controlled subsystems, such as engine controllers and data systems, for space flight and ground support avionics systems.

The objectives of these facilities are to:

- 1) plan and perform the analysis, design, development, and test of flight computers and data systems for space vehicles, experiments, and payloads;
- 2) design, fabricate, and test automated ground computer systems; and
- 3) plan and direct the analysis, design, development, and test of flight data systems including flight computers, data acquisition systems, data storage devices, and audio communication.

In support of these activities, the Avionics Department contains five different categories of laboratory facilities. The Audio Laboratory and the Design Simulation Laboratory provide state-of-the-art capabilities that are unique within MSFC. The other three are bench labs equipped with measurement, test, and instrumentation equipment used to support the development, assembly, integration, and testing of computers and data systems, supporting a wide variety of flight and non-flight projects.

Audio Laboratory

The Audio Laboratory is a facility for development and testing of flight audio subsystem designs. This facility consists of two main areas; an acoustically isolated test chamber and a control room. The test chamber provides a high degree of sound isolation from the outside area for

subjective evaluation of audio sound quality in the presence of controlled amounts of noise. The control room supports testing in the audio chamber and is a general-purpose audio laboratory for



bench testing of audio hardware, computer simulation of audio design concepts, and support for testing in the audio chamber.

The laboratory is located in Building 4477. The Control Room occupies 800 square feet of space and the Audio Chamber is 22' x 27' x 17' high.



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Design Simulation Laboratory

The Design Simulation Laboratory is the heart of MSFC's state-of-the-art electronic design capability. The hardware models located in this laboratory, are combined with the Very High-speed Description Language (VHDL) and Verilog CAD programs available at each designers desktop computer via network connectivity and floating licenses. Together, these tools support

Capabilities within the Design Simulation Laboratory come from simulators developed by Synopsis and Model Technology, then combined with Synopsis hardware modelers and software model libraries. Synthesis tools for Synplicity, Synopsis, and Exemplar allow rapid logic design and improved circuit performance. The hardware modeling system allows complex device model

development using the actual silicon for devices with up to 640 pins. Currently available models include the PowerPC603, MongooseV, the Summit controller for Mil-Std-1553, and other processes and complex I/O devices.

The Design Simulation Laboratory is located in Building 4487 and occupies 470 square feet of space.



board-level system simulation as well as the development of custom designs for Field Programmable Gate Arrays (FPGAs) and Application Specific Integrated Circuits (ASIC.) This allows for full logic simulation of hardware before prototype units are built.

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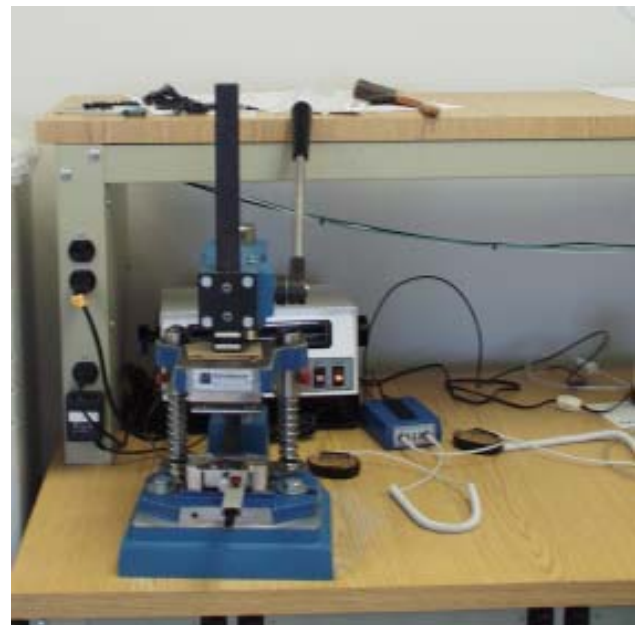
Programming and Forming Laboratory

In many cases, before components can be soldered to a circuit board, it is often necessary to modify the configuration of the parts. This is particularly true for computer and data system designs that rely upon embedded software, or programmable devices. Current designs also make extensive use of flat-pack style surface mounted parts. Ordinarily these parts are delivered to MSFC with the leads unformed, and attached to frames. These devices need to be formed into a footprint that matches the layout of the circuit board. The Programming and Forming Laboratory is used among other organizations within the Avionics Department, to prepare these component EEE parts prior to board assembly. The parts processed in this laboratory include development and prototype units, as well as parts for flight hardware.

The laboratory has the capability to program almost any type of electrically programmable part, including Programmable Random Access Memories (PROMs), Electrically Erasable Programmable Read Only Memories (EEPROMs), Programmable Logic Devices (PLDs) and Field Programmable Gate Arrays (FPGAs.) In addition, rewriteable devices such as UV-PROMs can be erased by exposure to ultraviolet light, then reprogrammed as desired. Current devices in use include Altera family PLDs and Actel FPGAs, as well as a variety of EEPROMs and PROMs. All of these activities take place at verified ESD workstations, which prevent damage to the devices during programming and handling. Normally programming steps must be performed prior to lead-forming of surface-mount components, as the programmers are designed to accommodate the footprint of the device as shipped from the manufacturer in the holding frames.

Lead forming is also performed on an ESD workstation. The laboratory provides the capability to cut away the holding frames and tie-bars, then form and cut the leads to the specified footprint. The former has been manufactured to provide the style of footprint approved by the Avionics Department's Electronic Packaging team, and provides the capability to adjust for the body-height of the part, as well as the configuration of where the leads exit the part body. Since one side of the device is formed with each operation, it is possible to form either dual flatpack or quad flatpack configurations. This provides virtually unlimited flexibility for the types of devices that can be formed.

This laboratory is located in Building 4487 and occupies 985 square feet of space.



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Ground Computers and Unit Test Development Laboratories

The Ground Computers and Unit Tester Development Laboratories are used to develop ground computer systems in support of flight and technology development projects. Examples of ground computer systems developed in these laboratories include engine controllers used to support test fires of engines.

Unit testers are provided for in-house-developed flight computer systems to provide the testing, acceptance, and qualification of flight items. Interface modules are developed to provide the testing of each flight unit interface, and test software ensures the proper operation evaluation of each unit being tested. Both the hardware and software for the unit testers will be developed and integrated together within these laboratories and then certified before use with the flight hardware.

An ongoing effort pursues the enhancement of ground checkout computer system concepts. Evaluation of current commercial off-the-shelf (COTS) products and techniques for the efficient flow of system data provides knowledge for development of future systems. Man/machine interface techniques are investigated to improve human interaction during space vehicle ground testing.

Past projects include the design, development, fabrication, test, and delivery of an automated checkout system for Spacelab level IV activities to the Kennedy Space Center (KSC). Key subsystems of the MSFC-delivered, level IV-related units are kept at MSFC to allow simulation of fault areas when problems are experienced at KSC. Through these activities, personnel can design rapid fixes for incorporation at user sites.

Both laboratories located in Building 4487 and occupy 2815 and 979 square feet respectively.



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Computer and Data System Hardware

Computer and data system hardware is tested, integrated, and verified within these laboratories. This includes the use of custom-designs, commercial-off-the-shelf (COTS) hardware or a combination of both.

In addition to supporting projects of the MSFC Product Line Directorates these laboratories also support ongoing research and technology projects such as the Center Director Discretionary Funds. The capabilities of test equipment and personnel in such areas as data acquisition, telemetry systems, optical data buses, and data storage is also maintained.

In order to conduct electronics testing, these laboratories possess a variety of state-of-the-art commercial test equipment such as oscilloscopes, multi-meters, function generators, precision power supplies, etc. More specialized equipment allows the monitoring and testing of Mil-Std-1553 data buses, VME computer communication, and other industry standards. In addition, custom test equipment, such as breakout boxes, unit testers, and other special test fixtures are frequently developed for each project and used in the test process.

The laboratories are located in Building 4487 and comprise six areas of 706, 985, 295, 767, 680 and 685 square feet respectively.



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